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ABSTRACT

One of a series offering practical advice and information on distance teaching, this broadsheet first looks at the reasons for trying to measure distance teaching costs and the methodological and economic difficulties involved in such measurements. Broadcasting and print costs in distance teaching are discussed, and evidence about the costs of distance teaching projects is compared, where possible, with the cost of conventional alternatives. Specific methods for analyzing costs are divided into those of particular value to either managers or to economists. Topics discussed in relation to costing for management include allocating costs, the cost of a course, the Snowden-Daniel variation, and measuring the cost of teaching, while the discussion of costing for economic analysis covers cost analysis, working out the costs, social discount rates, and the problem of cost variations over time. Conclusions include speculations on the future of distance education and cost-related factors. A list of inflation rate conversion factors is appended, and a 25-item reference list, 13 tables, and 4 figures are included. (LMM)

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THE COST OF DISTANCE EDUCATION

Hilary Perraton

IR011225

International Extension College 1982

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The International Extension College

The International Extension College exists to provide information and advice on distance teaching: a technique of education combining the use of printed material, broadcasts and face-to-face tuition. IEC is particularly interested in the use of distance teaching for nonformal and rural education. It is a nonprofit organisation registered as a charity under English law, and has links with the National Extension College and the Department of Education in Developing Countries of the University of London Institute of Education.

IEC works with governments and universities in third world countries to provide information, consultancy and training for distance-teaching projects. At the request of the governments concerned, we have started colleges in Mauritius, Botswana and Lesotho, and worked with the University of Lagos, Nigeria, in establishing a Correspondence and Open Studies Unit.

The literature on distance teaching is growing, but it is often hard to find. As a result, educators planning to use correspondence and broadcast teaching to stretch resources and increase opportunities have little chance of benefiting from the experience of others. IEC's *Broadsheets on distance learning* give practical advice and information in the use of distance teaching, drawn mainly from experience in the third world. They focus on rural education, on the techniques of distance teaching, and on case studies of distance-teaching projects. A list of titles in the series will be found on the last page of this *Broadsheet*.

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Contents

	Page
List of tables and figures	v
Part I: Reasons and problems	
1. Why ask about costs?	1
2. Why there are no simple answers	3
Methodological difficulties of costing	3
Economic difficulties	4
Part II: The evidence	
3. The costs of broadcasting and print	8
The costs of broadcasting	9
The costs of print	11
Conclusion	15
4. Comparative costs of distance teaching	18
What determines costs	18
How the costs behave	19
How the costs compare	21
Part III: The methods	
5. Costing for management	36
Allocating costs	36
The cost of a course	39
The Snowden-Daniel variation	43
Measuring the cost of teaching	47
Conclusion	49
6. Costing for economic analysis	51
Cost analysis	51
Working out the costs	53
Social discount rates	57
The problem of time	59
7. Conclusions	61
Appendix: Inflation rates	62
References	63

Tables and figures

		Page
Table 1	Comparative costs of radio and television	10
Table 2	The costs of printing	16
Table 3	Costs and success rates: distance teaching at primary and basic level	24
Table 4	Costs and success rates: distance teaching at secondary level	26
Table 5	Costs and success rates: distance teaching at tertiary level	30
Table 6	Costs and success rates: distance teaching for non-formal education	33
Table 7	Lesotho Distance Teaching Centre expenditure 1977/78	36
Table 8	Allocation of Lesotho Distance Teaching Centre costs 1977/78	38
Table 9	Proposals for Athabasca University 1980/81	45
Table 10	Possible effects of course development policies on Athabasca costs 1980/81	47
Table 11	Costs for radio section of Extension Aids Branch, Malawi	54
Table 12	Annual costs for radio section of Extension Aids Branch, Malawi	55
Table 13	Values of the annualisation factor *a (r, n)*	59
Figure 1	Costs of printing in Botswana	14
Figure 2	Comparative costs of conventional and correspondence enrolments	22
Figure 3	Comparative costs of successful conventional and correspondence enrolments	22
Figure 4	Costing of a correspondence course	40

Part I: Reasons and problems

In the first two chapters we look at the reasons for trying to measure the cost of distance teaching and the problems of making such measurements.

Chapter 1: Why ask about costs?

The proper study of mankind is man, rather than the cost of living. Teachers, with proper indignation, reject the idea that education can be measured in pounds, dollars or roubles. We emphasise the value of what we are doing in human rather than financial terms. And yet questions about cost will not go away. In the north and in the south teachers and planners find themselves up against the limits of their budgets, so that questions about cost loom large.

This broadsheet focuses on the cost of distance education, on the cost of print, correspondence courses, radio and television. Over the last two decades a lot has been written about the cost of education, and enough about the cost of distance education for some general conclusions to be possible. This broadsheet is, therefore, designed as a guide for people who may be asking questions about the costs of distance education. Some are managers, wanting to decide whether to teach one course rather than another, or use one way of teaching rather than another. Some are course designers, wanting to choose between alternative elements within a course. All are, properly, influenced by educational as well as economic arguments in making this kind of choice. As far as possible, those educational arguments are omitted from this broadsheet: it is just about costs. Its aim is to clarify the questions that can be asked about the costs of education, and suggest what answers can be expected from our current knowledge. It makes no attempt to estimate the value of education, or put a price on the benefits of education. Although economists do attempt such measurements, this broadsheet does not follow them into that methodological minefield. Our analysis does not go beyond asking about the costs of alternative means of achieving the same end.

This broadsheet tries to answer four questions:

How do the costs of using print, radio, television and recordings compare with each other?

Is distance teaching cheaper or dearer than conventional classrom education?

What are the costs of introducing a new course, or a new way of teaching, using distance-teaching methods?

How can we work these out?

We come to these questions in more detail in Chapters 3 to 6. They are asked by different people, and may have different answers for that reason. An economist, working in a ministry of planning, for example, will have different interests from a manager of a single institution. The economist, asking about the costs of distance education, wants to know about its costs to society as a whole. A planner within a ministry of education may, in contrast, be interested only in its effects on that ministry. The first may want to include the costs of broadcasting, for example in her* calculations, while the second, knowing that they won't be met from his* ministry's budget, will leave them out. In contrast, again, a manager may be concerned with much narrower questions. He may want, for example, to know how much to put in his budget for printing and broadcasting a new course. For this he will want to know about all the costs that will fall on his college for these activities, but may not want to know about the capital costs of his own headquarters. Or he may want to work out the cost of one part of his organisation's work in order to seek outside funds for it. In this case, it may be crucially important to include some overheads — the cost of his own time and his secretary's, for example — if he is not to seek too little money. Thus we are unlikely to find a single answer to the question 'what is the cost of a course?', or 'what is the cost of distance teaching?' The answer differs according to the person who asks it, and the different meanings which different people will, quite properly, assign to the word 'cost'.

There are other obstacles in the path of answering our four key questions. We look at these in Chapter 2 in order to set in context the answers we can give to them, which are discussed in Part II (Chapters 3 and 4). Then, in the third part of the broadsheet, we move from answers to methods and examine in Chapter 5 the methods used by managers for analysing costs, and in Chapter 6 those used by economists.

* We assume throughout, and quite arbitrarily, that economists are women and administrators are men.

Chapter 2: Why there are no simple answers

There are a number of difficulties in measuring the costs of distance education. We need to sketch these out, not so much to discourage efforts at costing, but to clarify the issues before looking at figures. In measuring costs, we want to know whether the cost of something is greater or less than the cost of an alternative, and how it compares with the amount of money we have to spend on it. In making such comparisons we face both educational and economic difficulties. We deal with each in turn.

Methodological difficulties of costing

In comparing the costs of distance teaching with the costs of alternatives, we want to compare like with like. In the experimenter's ideal world, we would be able to say that, for a given group of students at a given level, it is cheaper or dearer to use one educational method rather than another. In practice, things are not like that. Correspondence students, for example, are seldom exactly comparable with students at ordinary schools or colleges. Often correspondence is an alternative for students who are older than those at school, or live in more remote areas, or have done less well in previous examinations. Students of the Open University in Britain, for example, are different from other university students not only because they are studying part-time, but also because they are older and often come from a different educational background. So the first educational difficulty is that we can seldom compare like with like in terms of audience.

To make matters worse, it is often difficult to be precise about the audience for distance teaching. If we are teaching by radio, for example, we cannot be sure how many people are listening. If some of our listeners are signed up, fee-paying, correspondence students, while others are simply listening to the radio programmes, we may have two definitions of the size of our audience, one being ten times the other. That becomes important if we try to calculate a cost per student.

Again, where our audience is at a distance, we may be short of information about it: it is less easy to collect information from students at a distance than from students in a college. If a distance-teaching

organisation controls only part of its own teaching activities — as when it co-operates with, but does not control, a radio station — it may not even be possible to collect detailed information about all the costs of producing and distributing educational material.

A further educational problem arises where organisations do things other than teaching. Universities generally assume that their staff are engaged in research as well as teaching. An organisation like the Latin American radio school Popular Cultural Action of Colombia (ACPO) runs a publishing company and a radio station along with its educational activities. If we want to make any statement about the costs of its educational activities, we need to disentangle its teaching from its other work. Often, the same people, and the same buildings or equipment, have more than one role or function, so that this disentangling necessarily becomes an arbitrary process.

Economic difficulties

Over and above these broad methodological issues, there are a number which are more narrowly economic in nature. They fall into three groups: some concern the standpoint from which costs are analysed; some concern the audience for distance teaching; some concern the treatment of capital.

As we saw, the answer to a question will often depend on the stance of the questioner, and that will determine what is included in and excluded from the calculation of costs. A question about the cheapest way of teaching a particular course may yield different answers for a single institution from those for the national economy. The South West London College, a college in the public sector, for example, teaches students in day classes, in evening classes, and through correspondence. It found that in 1977/78 its costs for producing a graduate were:

correspondence	£1,577
day class	£1 404
evening	£2,075

It is quite clear which is the cheapest for the college. But, as it points out, if we looked at the figures from a national point of view, we would need to take into account as well the loss of production caused by the day-time attendance of the day students, and the attendance at a compulsory eight-week course of the correspondence studence. If that were done, the national, or social, cost might well be lowest for the evening class students (Birch and Cuthbert 1981, p.44).

Similar difficulties arise about the cost of supporting services for a distance-teaching institution. We may be forced into arbitrary decisions about what to include or exclude and at what figure. To take one

example, the voluntary organisation, *INADES-formation*, which was founded by the Roman Catholic bishops of West Africa, uses correspondence to teach agriculture to peasant farmers and agricultural extension agents. It is fairly easy to work out what are the costs of preparing and teaching its courses. But, in running seminars and publicising its work, *INADES-formation* relies heavily on the network of priests in the area, and there is no obvious way of putting a price on that tangible and intangible support. The standard rate of pay for a priest is not necessarily a guide to what you would need to pay a layman to do the same job.

Often, too, a distance-teaching institution may have access to broadcasting time: this may be at no cost, or at a nominal charge, or at what the broadcasting authority estimates as the full economic costs. In calculating the total cost of distance teaching, it is then necessary to decide which of these figures to use. Often, we have to choose between including the marginal cost of broadcasting — the extra costs which are incurred for one more hour of broadcasting, say — and the average cost, which would be calculated by taking the total costs of the broadcasting station over a year and dividing them by the number of hours of broadcasts. The average cost is almost certain to be higher than the marginal cost, so that the choice we make between the two may have a significant effect on our end result. And, again, the decision will depend on the analyst's standpoint. An Open University manager, knowing that the university must pay the BBC an average cost, will make different assumptions from a manager in an institution with access to free broadcasting time or one who just pays for the marginal cost of transmission. Where services of any kind are brought in from outside, but are not bought in an open market in the way we buy paper or printing machines, then problems are likely to arise in assessing their costs.

Next, there are two questions which concern the audience for distance teaching, and which cause particular difficulty when trying to compare part-time education at a distance with a full time alternative. In making such comparisons we need always to keep in mind whether we are comparing costs per student, or costs per successful student. Where students at a distance suffer from high drop-out rates, or low examination pass rates, it is quite possible for the cost per student to be lower than the conventional alternative, but for the cost per successful student to be higher.

The other question concerns the opportunity cost of studying. The problem is to find a way of valuing the time people spend on their studies and which they would otherwise spend on something else. When children are at school, we can usually neglect the opportunity cost of their time on the grounds that they would not, in any case, be

contributing to the economy. But with adults there are alternatives, which we may need to take into account. And, where tutors, or discussion group leaders, are working voluntarily, we may also have to work out the opportunity cost of their time. Major difficulties arise from this where groups of students studying at the same level are not comparable in the opportunity cost of their time, as when adults are following a course whose nearest equivalent is one taught in school.

Finally, there are difficulties in dealing with capital costs, which are those incurred for buying buildings, equipment, or anything else which has a life of more than one year. For some purposes, they can be omitted. If we are looking at the effects of producing one course rather than another at a single institution, our choice may neither affect nor be affected by the capital investment in the institution. If we are comparing the work of otherwise comparable institutions, one with old buildings and one with new, it may be more realistic to omit capital costs in comparing them. And an administrator concerned only with the expenditure of a recurrent budget, but wanting to compare different ways of spending the same budget, will not be worried about capital.

But, for many purposes, we do need to include capital costs in our calculations. If we want to compare the costs of a form of education which requires ordinary school buildings, and a classroom for every 40 children, with one that can manage without them, then we need to include the cost of those buildings. To make such comparisons, we need to derive an annual cost, or rent, from the capital cost. If, for example, a correspondence college buys a printing press for $50,000 and expects the machine to last for ten years, we need to spread that $50,000 across the ten years. Unless we do that, we will get a distorted picture of the college's costs for the year in which it bought the machine. And, as we shall see in Chapter 6, the calculation of such a rent is not straightforward, and may need to take account of prevailing interest rates.

Inflation presents us with a further difficulty here, as the value of money changes each year. To continue with the same example, if we assume that a college could earn 7.5% on any investment, then the annual cost of that printing press, including the lost notional interest, would be $7,284, calculated with the formula on page 58. But, if the college were now to replace the press and found that the cost had risen to $75,000, then the annual cost would rise to $10,926. Again, if a college is housed in buildings erected 50 years ago and paid off with a 60-year loan, then the loan charges for that college will be far lower than those for a college of exactly the same size put up last year.

There are various ways round the problem, and for different purposes different ones should be chosen. If we are comparing costs between colleges of further education in Britain, for example, it may be

most appropriate simply to omit building costs, because these vary so much from building to building, while not greatly affecting the nature of the activity within the building. If, however, we need a fuller picture and have to include such costs, then we may do better to estimate the costs of replacing our equipment, or the cost of renting a building comparable to the one being considered.

If we are simply concerned with the effects of inflation on recurrent costs, then we can allow for this by adjusting costs in line with an appropriate price index. Unless we do this, we get a misleading picture; from 1974 to 1978, for example, the costs to the National Extension College of teaching each student rose thus:

1974	1975	1976	1977	1978
£12.30	£14.03	£19.87	£22.14	£22.71

But if we use the retail price index to convert all these figures into 1978 values of the pound, we get quite a different picture:

1974	1975	1976	1977	1978
£22.34	£20.51	£24.93	£23.98	£22.71

(Jenkins and Perraton 1980, pp.79-80).

In the following chapters we shall try to make explicit how we can overcome, or avoid, each of these difficulties.

Part II: The evidence

In the next two chapters we look at the evidence on the costs of distance teaching. Chapter 3 discusses the costs of broadcasting and print, its two key components. Chapter 4 brings together the evidence about the costs of distance-teaching projects and compares these, where possible, with the cost of conventional alternatives.

Chapter 3: The costs of broadcasting and print

Distance teaching usualy depends on print, or broadcasts, or both. Broadcasting and printing share one quality which is important in analysing their costs. Many of the costs of making either broadcasts or printed materials are fixed, and do not vary with the number of listeners or readers. It costs no more to make and transmit a radio programme, for example, to an audience of a million than to an audience of a thousand. This contrasts with the cost of conventional education, where costs generally rise in proportion to the number of students being taught. Although you can squeeze a few more children into the average classroom, it is a reasonable working assumption that you need an extra teacher, and an extra classroom, for each extra class of children enrolled. As staff and building costs often amount to between 60% and 80% or more of educational budgets, the larger part of the costs of conventional education are variable, rather than fixed, and vary with the number of enrolments.

As many of the costs of producing educational media are fixed in this sense, economies of scale are possible. In Chapter 4 we shall examine the circumstances under which this quality means that distance education is cheaper than the conventional alternative. In this chapter, the focus is narrower and is on the comparative costs of different media. In making such comparisons we have to rely on evidence from a number of countries, despite the difficulty of doing so. The problems are considerable. The costs of production, for example, depend very much on wage levels, which vary widely from one country to another. The costs of distribution or transmission depend on the terrain, and on the cost of fuel, which also differ widely. But there is a value in comparing costs within countries between different media. And there is some value in looking at the range of costs for different media in a number of countries in order to see what order of costs may be expected

for particular media. We look in turn at broadcasting, including the use of cassette recordings, and at printing.

We face difficulties in doing this, because of the shortage of data. There are comparatively few studies which have looked at the cost of all three media: radio, television and print; even if we want just to compare radio with television costs, the data are limited. And few studies have looked in detail at the costs of print.

The cost of broadcasting

The assumptions made about broadcasting vary so much from place to place that generalisation between, rather than within, countries can be dangerous. In Britain, for example, the BBC's traditional concern with high engineering standards is reflected in all radio broadcasting. Transmission costs are higher than they are at small radio stations in countries where broadcasting is effectively uncontrolled by the state.

In analysing the costs of televison and radio it is convenient to separate the costs of production — those involved in making programmes; of transmission — those involved in transmitting the programme once it has been made; and of reception. Usually, the listener has to pay for the cost of reception. And costs of reception vary widely. The cost of receiving an educational programme at home, if you already have a radio or television set and mains electricity, is a very small fraction of the total cost. On the other hand, if the programme is to be used in a school, which has no existing television set, and needs a generator to power it, then the reception costs are much more significant. In the Ivory Coast, for example, reception costs were, in 1975, 44% of the total costs related to television for an educational television service (Eicher and Orivel 1980, p.132). For many distance-education projects, however, reception costs are relatively unimportant — because students already have radio or television sets and the extra cost of listening to one or two educational programmes a week is insignificant to them.

The costs of producing programmes in the studio and transmitting them over the air are often more important and Table 1 sets out these costs from four recent studies. These are, of course, total costs and, to make realistic comparisons, we often need to consider also the cost per student, or cost per student hour.

From the figures we can expect that television will cost between five and 30 times as much as radio. This is a bigger difference of costs than Jamison, Klees and Wells found in their study (1978, p.241); they estimated that television cost between three and five times as much as radio. But they appear to have included the relevant support costs — providing print materials, or training to the users of programmes — with the cost of the medium.

Table 1: Comparative costs of radio and television (Currency: 1978 US $)

Place and year	*Capital included in calculation?*	*Cost of radio per hour* *production*	*transmission*	*Total*	*Cost of television per hour* *production*	*transmission*	*Total*
Bangladesh							
1980[a]	Yes at 10%	n/a	n/a	34	n/a	n/a	902
Britain							
BBC							
1980[b]	depreciation included	3,822	278	4,100	47,634	1,814	49,448
Tanzania							
mainland	Yes at 10%	448	116	564	n/a	n/a	n/a
Zanzibar		n/a	n/a	297	301	986	1,287
1979[c]							

Notes

a. Edington *et al.* (1981).
b. BBC Handbook 1982, taking £0.42 = $1.00, and omitting local radio.
c. Edington and Mbunda (1979).

If we can expect audiences between five and 30 times as great for television — as we sometimes may — then it may make economic sense to use it. In many developing countries, however, we cannot expect to increase our audience by moving from radio to television — rather the reverse. As a result, the difference between costs per student hour may be even greater than Table 1 suggests: in Zanzibar, for example, it has been suggested that the cost per pupil hour of television could be over 80 times as high as the cost of radio (cf Mbunda and Edington 1979, section 2, p.1[illegible]).

So far we have assumed that the choice lies between broadcast radio and television. Sometimes it is possible to use recordings and distribute these rather than to broadcast. The Open University in Britain has investigated the possibility of distributing its programmes on cassette rather than through broadcasts (cf Bates 1982). In making the comparison it assumed that the production costs for radio, for example, and for sound cassettes would be the same: students would expect the same quality of programme no matter how they received it. They also knew that most students already had a cassette recorder as well as a radio. They therefore compared the costs of distributing cassettes with the cost of distributing the same programme by radio, by examining the case of a course with sixteen twenty-minute programmes or 230 minutes of radio. In 1976, in order to recover all their transmission costs, the BBC charged the university $216 per hour for transmission time; the University's analysis showed the distribution costs thus:

	$
Annual cost of broadcasts if transmitted once	1,152
Annual cost of broadcasts if transmitted twice	2,304
Cost per student of providing and distributing cassettes for same length of broadcasts	4.48

If we leave aside any questions about learners' convenience, or the value of broadcasts to eavesdroppers, these figures suggest that it will be cheaper to distribute cassettes than to broadcast, if the audience is less than about 250, for programmes broadcast once, or about 500 if they are to be repeated. Radio seems, from this study, to be a remarkably cheap form of distribution, even for quite small audiences.

The costs of print

We can divide the costs of printing and distributing printed material into four elements: development; setting of text; printing; and distribution. We will look at each of these in turn. Under the heading 'development' we include the costs involved in writing and editing material. In

the next stage text may be typed, for reproduction through offset-litho, or set in metal type or cut on stencils. The costs here may also include those for preparing illustrations. By printing, the third stage, we mean the physicial process of producing copies from whatever has been set in the previous stage. Distribution, the final stage, usually involves sending things through the post, but other methods may be used.

Development costs vary widely. They are affected by the ease of finding authors and their willingness or desire to write material which will be printed. At one extreme, academic publishers may find authors who want to write books and have them published and seek their rewards from kudos rather than from cash. If we tried to assess the rate per hour which an author of a learned text was receiving for his preliminary work and for the time he spent writing it would probably work out very low indeed. Such authors may not mind. In rich countries there are often plenty of them, they are not unionised, and publishers do not have to pay them very much. At the other extreme, one textbook project in the Philippines had such difficulty in finding authors that they paid $29,000 to the author of a school textbook. This was far more than many authors of such books could expect in many other countries. The development cost also includes the amount spent on editing texts. In a distance-teaching institution, the costs may therefore include both fees for the authors who are outside the building and expenditure on editors who are inside the building. Where the editor does a lot of work on a text, then editorial costs may well be higher than writing costs. With small print runs, of less than 5,000, these development costs are therefore likely to be a significant part of the total cost of producing printed texts. Omitting distribution costs, one National Extension College chemistry course for which a total of between 500 and 1,000 students were expected had development costs which reached at least 28% of the total. (These costs exclude overheads; if they were included the figure would rise above 28%). One of IEC's own broadsheets, printed in an edition of 1,000 copies, had development costs, including overheads, amounting to 82% of the total expenditure.

The costs of setting text vary according to the method used for printing. From Gutenberg's development of movable, mass produced, type in the fifteenth century until the second half of the twentieth century, print which used type was the norm. Today, in many countries which use Roman alphabets, a great deal of printing is done through offset lithography and is generally cheaper. For offset lithography, the original can be typed or written on paper, and a paper, plastic or metal plate is used as the master in the printing press. Individual letters of type are no longer required. As word-processors replace typewriters it becomes easier to produce copy for printing in this way. In a number of

countries, however, there are a large number of jobbing printers whose letterpress costs compete with those of offset litho. Where some materials cannot be set in type or typed on a typewriter, it may be necessary to employ calligraphers and the cost of preparing texts for printing is necessarily increased. At the Allama Iqbal Open University in Pakistan, for example, calligraphers are paid on the same scale as university lecturers.

Costs are also involved at this stage in preparing illustrations. Where material is to be produced through offset litho, it is then necessary to paste up the typescript and the line drawings or other illustrations from which plates for printing will be made. This can add significantly to the costs: IEC recently developed one course for teaching English on behalf of SWAPO and found that the cost of paste-up exceeded the cost of typing the material ready for printing.

There are two other factors which affect the cost of printing. The first is the cost of paper: this varies widely from one country to another, but there are also differences between the cost of paper for printing and duplicating. Printing paper is cheaper. One recent quotation in southern Africa, for example showed that paper for printing is 7% cheaper than duplicating paper. But that cost advantage has to be set against the higher cost of offset litho machinery. (One recent calculation suggests that one would only benefit from the lower price of printing paper after 10,000,000 copies. In practice, a choice between the methods is likely to be made on grounds of quality and maintenance rather than on the costs of paper). Second, offset litho plates may be either of paper, which can be good for a run up to about 500 copies, or metal, which is good for longer runs. The cost of a paper plate is about a quarter of the cost of a metal one.

Distribution costs naturally vary according to the length of the material printed and according to local circumstances. The variations are so wide that it is difficult to generalise. In making decisions about the use of one teaching medium rather than another, however, it is necessary to bear in mind the distribution costs for print. These behave quite differently from the distribution costs for radio and rise in proportion with the number of people receiving printed materials.

Of these four kinds of costs the first two — those of developing and setting printed materials — are fixed. The third cost, of printing, is generally variable and the amount of paper used is likely to be the most important determining factor. (Strictly speaking some of the costs here are fixed too; the rental cost of printing equipment is fixed, for example). The fourth cost, of distribution, varies with the size of the package to be distributed and the number of students to whom it is going. The total costs will obviously vary widely from one institution to another, but if we plot the cost per copy against the number of copies

printed of a text we will find that the curve generally resembles that in Figure 1, which shows recent costs for printing in Botswana. The wider we can spread the fixed development and setting costs, the lower will be the cost per student. Thus, if we want to keep down the cost per student we need either to keep down the development cost or to increase the number of students using the materials. Economies of scale can therefore apply. If we are concerned solely with printing costs, leaving aside development costs, then significant economies seem to appear between 500 and 1,000 copies. If those development costs are included in the calculations, then naturally economies of scale appear only at higher levels. But, beyond a certain point, there are few further economies of scale. In both Bangladesh and the Philippines studies have recently shown that there was no great reduction in the unit cost of producing print materials if you increased the order from 50,000 copies to copies in the millions.

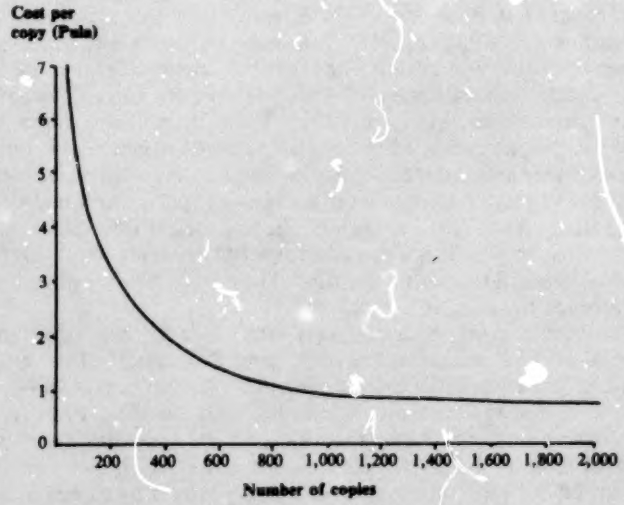

Figure 1: Costs of printing in Botswana
Source: See text. *Note:* P1.14 = $1.00

Table 2 sets out some recent figures for costs of printing. From this table we draw three conclusions. First, in many countries significant economies of scale in printing (leaving aside development costs) can be achieved with runs in the low thousands. This may be of importance for distance-teaching institutions offering courses where students will be

numbered in their hundreds or thousands, as opposed to the hundreds of thousands of schoolchildren for whom textbooks are produced. Second, the cost of producing text is in a number of cases so high that one does need a large print run in order to achieve economies of scale. Thus, the cost per copy of our United States example looks rather better than the cost of the shorter British example. In fact the total development costs for our own, IEC, example were of the order of $9,000 for a 96-page booklet as compared with $125,000 for a 256-page American publication. Third, if we consider print costs alone, there are, as one would expect, striking differences between costs in rich and in poor countries. In a variety of third world countries it looks as if it is possible to print the equivalent of 20 pages of A4 at around 10c in 1978 US dollars.

Conclusion

Unfortunately the data do not permit us to make direct comparisons between the cost of radio, sound cassettes, television and print. (There is even less information about the costs of educational films, video cassettes or telephone teaching, but these are of less importance to many distance-teaching institutions and have not been considered here). We do not have enough data for any one country to make a clear comparison even within that country, leave alone between countries. There is a particular shortage of information about the cost of distributing printed materials. Nor can we see how the use of one medium may affect the costs of another, although the Open University has suggested that using cassettes rather than radio could reduce print costs by leaving students with a permanent record of spoken programmes.

Five firm conclusions are possible:

— As radio reaches such large audiences in many developing countries, it is strikingly cheaper than any other medium.

— Radio is cheaper than television. Production and transmission costs are lower by a factor of 10 to 30, while costs including reception may be lower by a factor of 80 when measured in student hours.

— Cassettes are likely to be cheaper than radio for distributing programmes to restricted audiences. One thorough study suggests that radio will become cheaper only when there are 500 students or more.

— While television is relatively much dearer than radio, it can in some countries reach audiences so much larger that the cost per audience member is lower than for radio.

— Production costs for printing in black and white are such that costs per copy fall sharply at between 500 and 1,000 copies.

Table 2: The costs of printing

Country and type of publication	*Date of information*	*Length in pages*	*Print run*	*Cost per copy including development cost*	*Cost per copy excluding development cost*	*Equivalent cost of 20-page A4 publication in constant US 1976 $*[a]
Bangladesh[b]						
school textbooks: format not stated	1981	25	25m	n/a	$0.16-22	0.14-0.19
Philippines[c]						
school textbooks; size not stated; 40% one-colour illustrations	1979	200	50,000	$0.55	n/a	0.07
Botswana[d]						
correspondence course; A4; line drawings only	1981	100	1,000	n/a	$0.61-67	0.08-0.10
Malawi[e]						
bi-monthly magazine for farmers; illustrated with line drawings; 255 × 190mm	1980	16	32,000	$0.66	n/a	0.85[f]
Taiwan[g]						
school textbooks, 230 × 155mm	1972	500	1,500	n/a	$0.70	0.08

Colombia[h]						
monthly magazine for farmers; bigger than A4 in size; illustrated	1978	16	70,000	$0.21	n/a	0.26[f]
Britain[i]						
IEC broadsheet A5 print	1980	96	1,000	$12.51	$2.28	0.75[j] 4.17[f]
USA[k]						
book on costs of educational media about A5 in size	1978	256	7,500	$19.11	$2.45	0.38[j] 2.99[f]

Notes

a. We have used the same deflators as are used elsewhere in the broadsheet to convert to US 1978 $$ and have taken: Botswana PO.87 = $1.00; Malawi K0.83 = $1.00; Britain £0.43 = $1.00.
b. Edington *et al.* (1981).
c. Orivel (1979).
d. Personal communication from G.D. Leech.
e. Perraton, Jamison and Orivel (1981).
f. This figure includes development costs (e.g. writing and editing).
g. Based on Jamison, Klees and Wells (1978) p.116.
h. Perraton (1982b).
i. Costs from IEC file.
j. Printing cost only.
k. The development cost was estimated by Jamison, Klees and Wells (1978, p.70) at $125,000. We have assumed a print run of 7,500 and a print cost of $2.45.

Chapter 4: Comparative costs of distance teaching

As distance-teaching projects vary widely, we cannot expect a simple, single, answer to questions about their comparative cost. If we are comparing the cost of distance education with conventional education, then, for example, we expect different answers for projects using television from those using radio. However, a number of distance-teaching institutions have information about their costs and about their results. Information from 23 of these is set out in Tables 3-6, which cover projects in a range of countries and at differing levels of education. Most, but not all, of these use print linked with radio or television and with some face-to-face study. The annual cost per student varies widely, as does the comparative wealth of the countries represented in the tables, but some generalisations are possible, and we can compare some projects with orthodox methods of reaching the same ends.

What determines costs

Three factors are important in determining the cost of distance education. All have a bearing on the key question of the cost per student at a distance, as compared with the cost per student at school or college. The first is the level of education. The cost of conventional education reflects mainly the salaries paid to teachers, often between 65% and 80% of educational budgets. Where teachers are paid relatively little, as in primary schools, the cost per student is therefore relatively low. Where teachers are relatively well paid and the staffing ratio is more generous, as in universities, the cost per student is much higher. But a significant proportion of a distance-teaching institution's costs are the same, whether its students are at primary or tertiary level: it costs no more and no less to put up a building to house correspondence administrators for one level than for another and the cost of printing lessons or broadcasting to students is much the same regardless of level. Thus it is easier to get the costs of distance teaching below those of conventional education at tertiary level than at primary level.

The second factor is simple: the sophistication of the equipment

used. As we saw, television, for example, can cost between five and 30 times as much as radio. Colour printing costs more than black and white. There is, however, one complication here. Some projects, like the Ivory Coast school television service, or the radio schools in Latin America, have had to create a broadcasting service. Others, like the National Extension College, have been able to use broadcasting services, and networks of transmitters, which already exist. The costs falling on the educational body are lower in the latter case.

The third factor concerns size. It costs much the same to write correspondence lessons or make broadcasts for ten students as for ten thousand. As we saw, there are even savings in printing costs as numbers rise, for while the cost of paper increases with the number of students, the cost of preparing the text for printing, for example, does not. As a result, distance teaching is likely to prove more expensive than the alternative if there are only a few students. The teacher upgrading scheme in Kenya, for example, did not attract enough students for its results to be competitive with those of full-time education (cf. Hawkridge *et al.* 1982). In contrast, the British Open University has attracted so many students than it costs less than conventional universities, despite its use of the expensive medium, television.

In comparing costs, we often want to know about both the average cost per student and the marginal cost. The average, or mean, cost per student can, in principle, be found by dividing the total annual cost by the number of students. The marginal cost is, in contrast, the extra cost of teaching a single extra student. This figure enables us to see the financial consequences of expanding a distance-education project to teach more students. In order to determine these figures, we need to calculate the fixed costs — those which do not vary with the number of students enrolled — and the variable costs, which vary with each additional student (see Chapter 6).

Before looking at the application of these factors to different educational projects it may be helpful to see how the costs of distance teaching behave differently from those of conventional education.

How the costs behave

As we saw, the greatest proportion of conventional educational expenditure goes on the salaries of teachers. Much of the rest goes to provide buildings, and the equipment within them. As the number of students increases, the cost of education tends to increase proportionally. While, as we saw, you could teach an extra child in each class of, say, 30 without any extra cost (assuming the child sat on the floor and shared a book), if you wanted to teach another 30 children you would need an extra classroom and an extra teacher. We can

assume for all practical purposes that the costs of conventional education rise proportionally with the number of students. In other words, the variable costs, or the costs which vary with the number of students, are a very high proportion of the total costs of education. The costs of distance teaching are quite different. Some costs do vary with the number of students: the more students you have the more copies of course material you will need to print, and the more tutors you will need to employ to mark their work. But a large proportion of the costs will be for the central administration, for the writing and setting in type of correspondence courses, and for broadcasts. These costs are fixed, and do not rise in proportion to the number of students. (Although a major increase in the number of students would, of course, demand an increased central administration). It follows that, for a very small number of students, the fixed costs incurred for distance teaching may be so great that the cost per student is higher than a conventional alternative.

We can see this if we look at the cost of distance teaching, and the cost of conventional education, in England in 1979/80. In 1980 the National Extension College had 9,027 enrolments. Its total expenditure on correspondence work was £330,119, so that it cost £36.57 to teach each correspondence student. We can split its expenditure between fixed and variable costs: expenditure on tutors' fees, and a proportion of expenditure on printing and on postage, are variable, in that they rise with each additional student. We can set out the figures thus:

		£
Total expenditure		330,119
Variable costs		
tutors' fees	28,779	
printing	38,164	
postage	28,148	95,091
Fixed costs		235,028

The variable cost per student is £10.53; it costs the college only an extra £10.53 to teach each additional student it recruits. Assuming that the fixed costs would not change, whether NEC were teaching 9,000, 1,000 or 15,000 students, the total cost per student for different numbers of enrolments would be:

Number of students	*Cost per student (£)*
1,000	245.56
2,500	104.54

5,000	57.54
7,500	41.87
10,000	34.03
12,500	29.33
15,000	26.20

We can make an extremely crude comparison between this figure and that of conventional education at secondary level, roughly the level at which most of NEC's courses were pitched. (The point of the comparison is to look at the behaviour of the costs rather than to make claims of equivalence between distance and conventional teaching). The average cost of the education at state secondary schools in 1979/80 was £633. If we assume that a year's secondary course is the equivalent of six of NEC's single-subject courses, we can see that the cost of studying one subject at school was £663/6 or £105.50. This cost was not dependent on the number of children at school: it would be much the same for large schools or small, or for large education authorities or small. Figure 2 shows how the costs compare. It shows that, provided we can accept the very crude comparison between correspondence course and school, the correspondence course is cheaper once we have more than about 2,500 students.

But this is not the end of the story. Figure 2 simply shows the cost per student enrolled, regardless of how successful or unsuccessful the students are. We may want to know about the cost for each successful student rather than the cost per student enrolled. We know that the drop-out rate in correspondence education is often high. If we assume that two-thirds of the children in school will finish their courses successfully, but that only one-third of the correspondence students will do so, then we get quite different sets of costs per successful student. These are set out in Figure 3. They show that if we are concerned with successful students, rather than with enrolments, distance teaching *in this example* looks cheaper provided we have some 6,300 correspondence students, rather than 2,500 which seemed enough when our criterion was simply the number of students taught. In this example, too, we can see that if the success rate for correspondence students fell to about one-sixth, then the cost per successful student would probably always remain above the cost for conventional education.

How the costs compare

We can now look in more detail at the costs and the evidence at primary, secondary and tertiary levels, and for non-formal education. Tables 3-6 set out the key facts. (Basic education, where it is com-

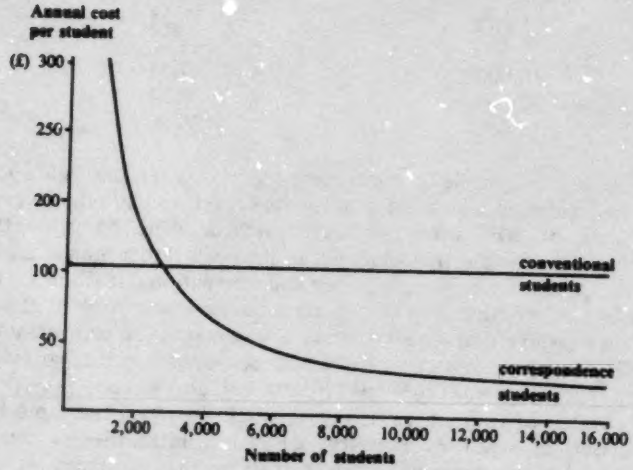

Figure 2: Comparative costs of conventional and correspondence enrolments

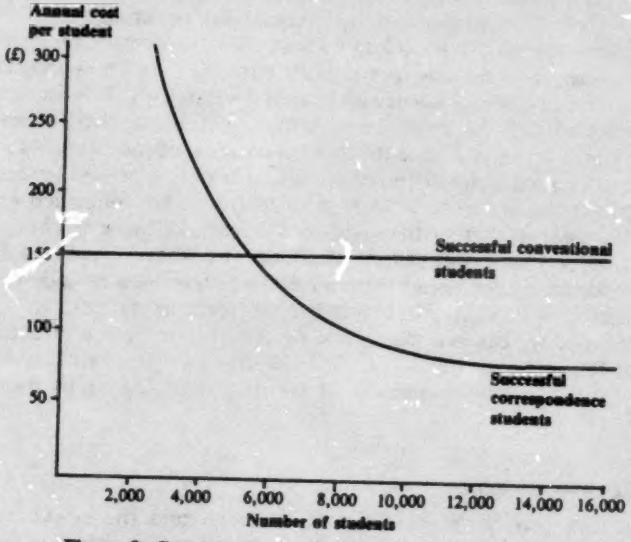

Figure 3: Comparative costs of successful conventional and correspondence enrolments

parable with primary education is under that heading). Each of these is discussed in turn. In each table we set out the basic information about projects, including the number of students enrolled and the cost per student. For ease of comparison we have expressed all costs in 1978 US dollars. The tables also show whether the calculations include the capital cost and what evidence there is about the success of the project. Where possible, we also compare their costs with those of orthodox education.

Distance teaching has not been widely used at primary level, mainly because children seem to need the structure of a school, and the support of teachers, if they are to learn effectively. But there are important exceptions (see Table 3). In Latin America a number of radio schools have used print and broadcasts to reach small groups of adults wanting to follow courses at primary level, which lead to examinations equivalent to those used at primary school. The groups have leaders and co-ordinators, who provide them with some face-to-face support, but no teachers. *Acción Cultural Popular (ACPO)* in Colombia and *Radio Santa Maria* in the Dominican Republic used this pattern of organisation. In Mexico *Radioprimaria* was different: it provided radio lessons for children, not adults, and to children who were in school. But it enabled children to be taught with fewer and less well qualified teachers. In the Ivory Coast television has been used on a large scale, with extensive print support and with teachers with only a limited training. Here, as with *Radioprimaria,* the broadcasts were directed to children in school.

Both these schemes employed teachers, so that there was little chance of making major savings in staff costs. But *Radioprimaria,* even with only 2,800 students a year, was cheaper than conventional education if we consider the number of students enrolled; we cannot say how the cost per successful student compares. It used radio, not television, and had a much less favourable staff:student ratio than the conventional schools. In the Ivory Coast, the cost of setting up a television network principally for education, and of paying the teachers salaries near to those of the regular teachers, meant that the scheme proved more expensive than conventional education, even with nearly a quarter of a million students.

The radio schools of Latin America are aimed mainly at adults and do not employ face-to-face teachers. As a result their variable costs are low, despite the high fixed costs which they incur through their relatively large organisations and their operation of their own radio stations. Even if we take as a criterion the number of students successfully completing a course, then the cost at both *ACPO* and *Radio Santa Maria* was lower than for conventional education. These radio schools has 70,000 and 20,000 students respectively.

Table 3: Costs and success rates: distance teaching at primary and basic level

Country, institution and date of studies	*Type of project*	*Approx. annual enrolment at time of study*	*Annual cost per student in US 1978 $s*[a]	*Capital included in calculations?*	*Measures of success measure used*	*rate*	*Comparison between costs of distance teaching and costs of orthodox education*
Colombia ACPO (radio school) 1972/76[b]	Primary equivalent mainly for adults	70,000	34	Yes at 10%	Number taking end-of-course examination	53-56% (1962-66) 22-26% (1967-68)	D/t is cheaper
Dominican Republic RSM (radio school) 1975[b]	Primary equivalent mainly for adults	20,000	30	Yes, at estimated figure	Number taking examination for promotion to next stage	56-69%	D/t is cheaper

30

Mexico Radioprimaria 1972[c]	Primary: radio lessons with fewer teachers for schoolchildren	2,800	160	Yes, at 7.5%	Standardised tests administered to Radioprimaria and conventional school students	comparable scores	Cost per student lower ($160 instead of $259) but no information about cost per completion
Ivory Coast television 1975[d]	Primary: television with print support print support and teachers for schoolchildren	231,000	268	Yes, at 7.5%	n/a	n/a	Cost per student higher ($268 rather about $182)

Notes

a. Costs generally converted using the deflators in the Appendix.
b. These costs are summarised in Perraton (1982b), where sources are given.
c. Jamison, Klees and Wells (1978), pp.139-147.
d. Eicher and Orivel (1980), taking recurrent costs from Table 23 for 1975, reflating to 1978 by using an index of 1.32 (reflecting changes in the value of the French Franc) and taking 225 CFA as US$1.00.

Table 4: Costs and success rate : distance teaching at secondary level

Country, institution and date of studies	*Type of project*	*Approx. annual enrolment at time of study*	*Annual cost per student in US 1978 $s*[c]	*Capital included in calculations?*	*Measures of success measure used*	*rate*	*Comparison between costs of distance teaching and costs of orthodox education*
Brazil IRDEB[b] 1977	Secondary	8,000	67	Yes, at 7.5%	Examination passes	37%	D/t is probably more expensive
Canary Islands ECCA (radio school)[c] 1978	Upper primary/lower secondary	23,000	64	Yes, direct rate not stated	Number promoted to next class after 6 months study	72-75%	D/t is cheaper
Kenya Correspondence Course Unit[b] 1977	Teacher Training	340-2,900	325	Yes, at 7.5%	Teachers promoted as a result of course	90%	D/t is more expensive
Malawi Malawi Correspondence College[b] 1976	Secondary	3,800	160	Yes, at 7.5%	Examination passes: as proportion of enrolments as proportion of exam entrants	13% 21%	Cost per successful student dearer than for day schools but cheaper than for boarding schools
South Korea Air Correspondence High School[b] 1974-77	Secondary	20,000	68	Yes, at 7.5%	Examination passes	46%	D/t is cheaper
Mexico Telesecundaria[d] 1972	Secondary: use of television to extend range	29,000	235	Yes, at 7.5%	Standardised tests administered to Telesecundaria and conventional	Comparable scores	Cost per student lower ($235 instead of $316) but no

	of schools using under-qualified teachers				school students		information about cost per completion
United Kingdom National Extension College[a] 1965/78	Secondary: correspondence courses for individual adults	7,600	60[f]	Yes, at 7.5%	n/a	n/a	Courses probably cheaper than evening classes, certainly cheaper than full-time classes. Cost per successful student not known.
Brazil Minerva[b] 1977	Secondary radio, print and some face-to-face support for out of school equivalency exam	177,000	25	Yes, at 7.5%	n/a	n/a	D/t is probably cheaper
Canada Tévec 1969[g]	Lower secondary equivalence courses for adults using print, broadcasts and counsellors	25,000	Not known	Not known	Proportion of population of 25-54 enrolled. Proportion of enrolled students passing examination		Stated to be cheaper than in-school alternative ($3m instead of $25m)

Notes

a. Costs generally converted using the deflators in the Appendix.
b. These costs are summarised in Perraton (1982a), where sources are given.
c. These costs are summarised in Perraton (1982b), where sources are given.
d. Jamison, Klees and Wells (1978), pp.217-235.
e. Jenkins and Perraton (1980).
f. This is a cost per course, usually completed in about a year, taking £0.53 = US$1.00.
g. *Direct*, January 1975, p.36.

At secondary level, distance teaching has been more widely used, and has employed print, radio and television in differing proportions (see Table 4). Some projects have aimed mainly at individuals: the *National Extension College* in England and the *Air Correspondence High School* (ACHS) in South Korea have done most of their teaching through correspondence. The NEC courses for which costs are available excluded radio, while ACHS used radio three or four times a week. ACHS organised compulsory tutorial sessions for their students twice a month. Both institutions have concentrated on individual students wanting to reach secondary-level qualifications. In Brazil there has long been a secondary qualification, the *madureza,* available to adult students who did not attain a comparable level at school. *Minerva* and *IRDEB* have provided courses, on a federal and a State basis respectively, for adults seeking the *madureza,* who worked mainly as individuals. Both projects have used television, supported by print and with limited opportunities for students to meet together. In Kenya the *Correspondence Course Unit* has used radio and correspondence courses to provide teaching in academic subjects, at secondary level, for untrained teachers. In Quebec the *Télec* project used radio, television, print and visits by *animateurs* to provide education at secondary level for adults who had not got that far at school, in a relatively poor part of francophone Canada. The project attracted very large numbers of students.

Two other projects at this level have involved a much larger proportion of group study. *Radio ECCA* in the Canary Islands is a radio school, and used methods similar to those of *ACPO* and *Radio Santa Maria,* aiming its secondary-level courses at small groups of adults. In Malawi the *Malawi Correspondence College* provided an alternative to secondary education in study centres, where young people who failed to get entry to secondary school on ending primary education studied under the guidance of tutors, but with the teaching materials coming through correspondence and radio lessons.

Distance teaching proved more expensive than the conventional alternative in two of these cases: the Brazilian *IRDEB* scheme, which used television but reached only some 8,000 students, and the Kenya *Correspondence Course Unit,* which used radio and print but for which annual enrolments fell between 300 and 3,000. In Malawi, with 3,800 students, the cost per successful student was lower than the cost for boarding schools but higher than the cost for day schools. In Mexico, *Telesecundaria* had 29,000 students and its costs per student were only three-quarters of those for a conventional school. We know nothing about costs per successful, completing student: if drop-out and failure rate were more than 25% worse than for conventional education, then *Telesecundaria's* costs would be higher. But *Telesecundaria* required

students to attend alternative schools, operating during the day, and with fairly high staff costs. In contrast, the *Air Correspondence High School* in South Korea, the *Télévec* project in Quebec and *Radio ECCA* in the Canary Islands all relied on students working at home and, with between 20,000 and 25,000 students, all achieved results in terms of examination performance which were strikingly cheaper than the conventional alternative. (The figures from *Minerva* in Brazil and from the British *National Extension College* do not allow us to make strict comparisons).

At secondary level, then, we can conclude that we can probably expect the costs of distance teaching to be lower than those of conventional education at somewhere between 5,000 and 10,000 students a year, provided they are expected to work at home and not to require full-time monitors or teachers. At enrolment levels between 20,000 and 30,000 a year, distance teaching is very likely to work out cheaper. The thresholds may be higher than this if television is used extensively.

Distance teaching has expanded rapidly at tertiary level over the last ten years, but relatively few cost studies have been published which are based on actual expenditure, as opposed to budget forecasts (see Table 5). The *Open University* in Britain uses print, radio, television and some face-to-face sessions to teach at degree level to part-time students. Its costs are well documented. Two much smaller schemes in Britain have produced figures for their costs. The *Doncaster Institute of Higher Education* provides, among other courses, one for the Institute of Quarrying, which is available both through a correspondence course and through regular attendance at the Institute. Similarly, the *South West London College* offers a Higher National Certificate in Business Studies through correspondence or through part-time attendance at the college, either during the day or in the evening. The students of the Open University do not need any formal qualifications for entry to their courses, in contrast with other British universities; the other two colleges require the same entry qualifications (roughly success at the end of a seven-year course of secondary education) for correspondence as for regular students.

Open universities working on somewhat similar lines to the British Open University, have been set up in a number of developing countries. Detailed figures are available of the costs of two of these universities, the *Universidad Estatal a Distancia* of Costa Rica and the *Universidad Nacional Abierta* of Venezuela; for the Costa Rican university it is also possible to compare the costs with those of conventional universities. Similar comparisons have been made for *Everyman University,* Israel: they need to be treated with some caution as they rely more heavily on forecasts than other studies. All these universities use print, broadcasts

Table 5: Costs and success rates: distance teaching at tertiary level

Country, institution and date of studies	*Type of project*	*Approx. annual enrolment at time of study*	*Annual cost per student in US 1978 $*[a]	*Capital included in calculations?*	*Measures of success measure used*	*rate*	*Comparison between costs of distance teaching and costs of orthodox education*
UK Open University 1971/79[b]	University	25,000	1,177	Yes	Graduates as proportion of final registration	54%	D/t cheaper per graduate produced than orthodox university
UK Doncaster Institute of Higher Education 1977/78[c]	Professional qualification	75	750	No	Final examination passes as proportion of entrants to 3-year course	52%	D/t cheaper. Costs per graduate are: $7,889 conventional, $4,758 d/t
UK South West London College 1977/78[c]	Professional qualification	150	524	No	Final examination passes as proportion of entrants to 2-year course	35%	D/t cheaper than evening classes but dearer than day-release classes. Costs per graduate are: $2,667 day release, $2,996 d/t, $3,942 evening classes
Israel Everyman University 1978[d]	University	8,000	740	Yes	Graduates as proportion of enrolment	forecast 37.5%	Cost per graduate estimated at $5,600 compared with

							$11,000-$12,000 at conventional universities
Costa Rica Universidad Estatal a Distancia 1980[e]	University	8,150[f]	653[f]	Yes	n/a	n/a	Cost per student lower than at conventional universities Cost per credit comparable with that of larger conventional university, lower than that of small conventional university
Venezuela Universidad Nacional Abierta 1980[g]	University	13,400[f]	1,248	Yes	n/a	n/a	n/a
Canada Athabasca University 1979/80[h]	University	4,400[i]	777	Yes	n/a	n/a	Costs are within the range of comparable Alberta conventional universities

Notes

a. Costs generally converted using the deflators in the Appendix.
b. Wagner (1980), taking his figures for 1976/79 of 1976 £500 as equivalent to 1978 US$1,177.
c. Birch and Cuthbert (1981) and taking £1.00 = $1.90.
d. Perraton (1982); these are in fact 1977 $$.
e. Rumble (1981) with his figures adjusted by 21.4% to allow for 1978/80 inflation, as suggested in his footnote 3.
f. This figure is for full-year equivalents.
g. Rumble (1982), with costs in 1980 $$.
h. Snowden and Daniel (1979) with figures in 1979/80 Canadian $$, taking Canadian $1.16 = $1.00.
i. Course enrolments.

and some face-to-face study for teaching at university level. Similar methods are used at the rather small *Athabasca University* in Canada, which is also unusual in the extent to which it uses course materials bought from other institutions, rather than developing them for itself.

A number of cost studies have been made of the *Open University* in Britain, showing that it can produce graduates more cheaply than conventional universities, despite its considerable use of radio and television. The break-even point in 1971 was calculated at 21,691 (Laidlaw and Layard, 1974, p.455); in other words, once the university had over 21,691 students, its costs per student should be lower than those for conventional students. The other open universities similar to it have produced similar results, leading Rumble to conclude that universities with 10,000 to 20,000 students are 'probably critically balanced, in so much as their unit costs are on a par with or below those of campus-based institutions' (Rumble 1982, p.138). The evidence from Athabasca, and from the two small British projects, shows that very much lower costs can be achieved at this level under some circumstances. The evidence from *South West London College* has to be treated with some care: it appears to have paid the writers of the correspondence materials at a very modest rate. The *Doncaster Institute* figures suggest that, if we are to use very simple distance-teaching materials, relying on print with no broadcasts, then at tertiary level we may reach that break-even point at very small figures, measured in hundreds rather than thousands. The quality of production of teaching materials and the presence or absence of broadcasting are clearly all-important in explaining these striking differences in costs.

When we move from formal to non-formal education, we can no longer talk so readily about levels. Distance teaching has been widely used for non-formal purposes and we have some information about its costs: evidence about comparative costs is inevitably here difficult to find (see Table 6). The radio schools of Latin America, which we have already discussed, have been concerned with both formal and non-formal education. In Botswana and Tanzania radio campaigns have been used. In these, large numbers of radio learning groups have been established, each with a study group leader, and supported over a matter of two or three months by radio programmes and print materials. In both countries the aim has been to recruit into groups a very large proportion of the adult population. The *Tribal Grazing Land* campaign in Botswana used these techniques to introduce a new government programme for the use of land and the pasturing of cattle. The bigger campaigns in Tanzania were on health and nutrition and aimed at improving health practices among large numbers of peasant farmers. *INADES-formation*, in contrast, uses correspondence courses

Table 6: Costs and success rates: distance teaching for non-formal education

Country, institution and date of studies	*Type of project*	*Approx. annual enrolment at time of study*	*Cost per student in US 1978 $$[a]*	*Capital included in calculations?*	*Measures of success measure used*	*rate*	*Comparison between costs of distance teaching and costs of orthodox education*
Botswana Tribal Grazing land radio campaign 1976[b]	Adult campaign using radio, print and group meetings	55,300	9[c]	Omitted	Percentage of adult population taking part in campaign	17%	Programme could not have been offered conventionally
Tanzania Radio campaigns 1973-75[d]	Adult campaigns using radio, print and group meetings	2 to 2.5 million	1-5[c]	Omitted	Actions by participants to improve their own health practices	Some evidence of changed health practices	Programme could not have been offered conventionally.
Cameroon INADES-formation 1978-79[e]	Correspondence courses for peasant farmers	570	239	Included at 7.5%	n/a	n/a	Uncertain
Rwanda INADES-formation 1978-79[e]	Correspondence courses for peasant farmers	1,000	107	Included at 7.5%	n/a	n/a	Probably cheaper

Notes

a. Costs generally converted using the deflators in the Appendix.
b. Ministry of Local Government and Lands (1977).
c. This is a cost for the campaign, lasting for two to three months of intensive activity.
d. Perraton (1982b).
e. Jenkins and Perraton (1982).

to teach better farming to peasant farmers in a number of countries, mainly in francophone west Africa. Costs are available for their work in Cameroon and Rwanda.

As we saw, the radio schools show that their methods, which have been used for non-formal as well as for formal education, can reach large numbers of adults at costs which are lower than the conventional alternative. While the costs for radio campaigns in Botswana and Tanzania are difficult to interpret, the cost per head most probably lies between $1 and $10, with the lower cost for the larger campaigns. Hall has argued that we should compare these costs with the costs that would have been incurred if, say, the building of latrines were done by government labour rather than by village action stimulated by the campaign. The costs for *INADES-formation* are very much higher than this: they reflect both the extent of the support *INADES-formation* gives to its students and the relatively low number of enrolments. If any generalisation is possible, it seems that where non-formal programmes have participants measured in tens or hundreds of thousands, economies of scale can be reached through distance teaching. We do not have enough evidence to say what the lower threshold is.

A fuller analysis of the comparative cost of distance and conventional education will be possible only as more evidence about the cost of both emerges. In Chapter 6 we discuss some of the techniques needed to get that evidence. And, while we can be fairly confident about comparisons between different forms of education in any one country — keeping in mind the difficulties discussed in Chapter 2 — we need to tread with much more care in making comparisons between countries. Doubts about such comparisons are increased by the variety of programmes lumped together under the general heading of distance teaching — some using teachers and other not, some using television and others not, some arranging regular meetings for students and others not, and so on.

Nevertheless, the bold and simple question 'When is distance teaching a cheap alternative?' is not readily dismissed; it forces us to stack up the bricks of argument into the best edifice we can, despite the shortage of the tough straw of rigorous costing. Four tentative conclusions look likely.

First, it is very difficult to provide formal education at primary level more cheaply than through conventional primary schools. The projects which have done so have got a long way from a parallel with orthodox schools, and have used methods which succeed for some adults and adolescents but would be unlikely to work for children.

At secondary level, it looks as if distance teaching out of school is likely to be cheaper than the alternative provided there are something like 10,000 students a year.

At tertiary level, we would expect the number of students needed for distance education to prove cheaper than the alternative to be much lower than this, but we do not have enough data to suggest a similar bottom figure. The Open University of Britain and others like it are not an adequate guide: the British Open University's sophistication, and extensive use of television, for example, make its costs appreciably higher than some of the non-conventional tertiary alternatives. Despite this, its graduates cost society less than those from conventional universities.

Our only conciusion for non-formal educaton is more agnostic: comparisons between distance-teaching methods and the alternatives are so difficult that we can only say that some, large-scale, non-formal programmes look cheap in comparison with other kinds of expenditure on education or social welfare.

Part III: The methods

In Chapters 5 and 6 we look in more detail at ways of analysing the cost of distance education, looking first at methods of particular value to managers and then at methods for economists.

Chapter 5: Costing for management

The manager is interested in the analysis of costs both as a means of controlling expenditure and as a tool for effective management. The analysis of costs enables him to budget more easily and to price courses. If the analysis is taken further, it will help managers who are planning both distance and orthodox education. In order to do such analysis we need to start by allocating costs to activities.

Allocating costs

Effective planning and management demand that we know how much is spent on what. For example, we are often likely to want to know how much it costs to produce a single unit of a course, or teach a single student; we need to break down our budget in order to discover this. The major budget headings are a starting point for this, but seldom give enough detail for management, as opposed to financial control. For example, in 1977/78 the Lesotho Distance Teaching Centre budget had four main headings, with the actual expenditure, in Rands, as in Table 7.

Table 7: Lesotho Distance Teaching Centre expenditure 1977/78

	Currency: SA Rand
Staff expenses including training	73,979
Materials, courses, use of equipment	31,903
Travel	11,487
Maintenance	6,956
	124,325

A breakdown of expenditure like this may be adequate to satisfy a ministry of education finance section, or for that section to estimate the next year's expenditure (although in practice they would probably de-

mand rather more detail). But it is not adequate for the management of the Centre. In that year, LDTC had five service sections — administration, overheads (which included the director and management), production, research and radio. The function of all these sections was to provide services to the four departments of the Centre which were concerned directly with students: rural education, a literacy and numeracy project, a student advisory service for individual students, and a course-writing section. For management, LDTC needed to know the total cost of these latter four departments.

It is not difficult to discover many of the direct costs for each department. The details of salaries which the Centre necessarily keeps, for example, enable it to see how the salary bill of R73,979 is divided between the five service sections and the four teaching departments. Other costs are slightly more difficult: there is no immediate way of discovering how transport costs should be shared in the same way between departments. But, by analysing log books which show the departments responsible for each journey, it is possible to calculate how these costs should be attributed. Precise accuracy is not important. As Theo Derkx, the administrator of LDTC, says:

> I have found that . . . those record systems that are based on automatic counters work extremely well. Such are, for instance, vehicle log books, photocopying records . . . the production book. All jobs are entered, but in a very simple fashion, such as the number of A4 pages (or A5) and number of copies wanted . . .
>
> The idea is really to come to some sort of accounting system that tells you roughly what each project costs and which at the same time does not require the employment of a new full-time member of staff to keep track of it all. The system we use is not 100% accurate, but it is sufficiently accurate to give figures that are not much more than 5% out.

In this way, it is possible to break down the Centre's costs between the nine spending sections and departments. These are shown in the upper part of Table 8.

We can now go one stage further. In order to see the full cost of each teaching department, it is necessary to eliminate all the figures for the five service sections, by re-allocating their costs to the teaching departments.

Again, some parts of this calculation are simpler than others: the production book will enable one to allocate the printing costs to departments by reference to the amount of work they have actually had printed. Others are inevitably more arbitrary: it is necessary to make a decision, on the soundest basis one can find, about the proportion of administrative or research costs which are to be borne by, say, the rural project rather than the student advice section. LDTC has made those

Table 8: Allocation of Lesotho Distance Teaching Centre Costs, 1977/78

Currency: SA Rand

		Service Sections					*Teaching Departments*			
	Total	*Admin.*	*Over-heads*	*Printing and production*	*Research*	*Radio*	*Rural*	*Literacy and numeracy*	*Student advice*	*Course writers*
Staff expenses (incl. training)	73,979	7,466	7,961	16,644	2,432	7,611	9,186	10,717	8,810	3,152
Materials, courses, use of equipment	31,902	6,831	—	13,556	435	1,504	4,652	1,875	1,461	1,589
Travel	11,487	2,298	2,458	—	747	149	919	1,999	2,458	459
Maintenance	6,956	3,861	730	298	143	96	277	621	635	295
Total costs directly attributable	124,325	20,456	11,149	30,498	3,757	9,360	15,034	15,212	13,364	5,495
Admin. allocation	—	20,456	877	6,842	1,711	2,276	1,499	2,276	2,954	2,021
Overheads allocation	—	—	12,026	1,203	1,203	1,203	2,405	2,405	2,405	1,202
Prod. and print allocation	—	—	—	38,543	3,012	78	1,995	6,861	3,865	22,732
Research allocation	—	—	—	—	9,683	—	3,937	1,937	2,904	968
Radio allocation	—	—	—	—	—	12,917	1,292	—	11,625	—
TOTALS RE-ALLOCATED	124,325	—	—	—	—	—	26,098	28,691	37,118	32,418

allocations in sequence, as shown in the lower half of Table 8. The administrator has first re-allocated the costs of the administrative section to the other eight headings, then re-allocated the costs of overheads, and so on. The end result is shown at the foot of the table where the 'totals re-allocated' show the total costs that should be attributed to the four teaching departments.

What does this tell us? Its main function is to provide information which will make for effective management. Once the exercise has been completed, it is quite easy for LDTC, for example, to work out the cost per volume produced, taking into account the total expenditure that ought to be attributed to course production, and not just the amount spent on direct production costs. If, for example, we stopped the analysis at the stage of allocating the direct costs, LDTC might assume that course writing absorbed only 4% of its budget (R5,495) and not the 26% (R32,418) which the re-allocation stage shows. It enables LDTC to ensure that the funds it receives for its more experimental work are adequate, and that this is not unintentionally being cross-subsidised by other activities. And it enables clearer decisions to be taken about priorities.

Obviously the precise system used for calculating and allocating costs between departments will differ from one institution to another. Some method of allocation is necessary if managers are to have the information they need. An important merit of LDTC's model is its simplicity.

The cost of a course

An analysis of the kind just done makes it possible to calculate the cost of introducing a course and seeing whether this makes financial sense or not. Figure 4 sets out one way of doing this. It shows how a notional college, the People's Education Centre, which we created as a teaching exercise, decided whether or not to produce a course in revolutionary literature. The form used is based on one developed at the National Extension College. The form, on the right hand page, shows all the elements which make up the total production costs for a correspondence course. An analysis of the kind done for Lesotho in Table 8 enables printing costs, for example, to be worked out in Figure 4. There are a variety of different ways of dealing with overheads: in this case, instead of allocating overheads as in the lower part of Table 8, the Centre has simple divided the total overhead costs by the annual enrolment and decided how much each subject enrolment must contribute to the running costs of the Centre.

This method of course costing depends on experience: by the time

Figure 4: Costing of a correspondence course

		Notes
Title Revolutionary literature	Length 300pp A4	1, 2
Assignments (a) 16	Marking fee (f) 0·75	3, 4
Life (y) 4 years	Annual enrolment (e) 250	5, 6
Proposed fee (p) 18	Overheads per student (h) 4·46	7, 8
Annual text usage volume 1 (s) 250		9
volume 2 (3/4 s) 190		10
volume 3 (3/5 s) 150		11
Total (u) 590		12
Production costs		
Authors' fees 420		13
Edit, design, set 960		14
Total generation costs (g) 1380		15
Printing (y × u × print cost per volume) (r) 2926 (4 × 590 × 1·24).		16
Annual costs		
Generation cost (g/y) 1380/4 345		17
Print cost (r/y) 2926/4 732		18
Tutors' fees (0·6 × a × f × e) (0·6 × 16 × 0·75 × 250) 1800		19
Overheads (e × h) (250 × 4·46) 1115		20
Extra costs (e.g. radio)		21
3992		
TOTAL ANNUAL COST		
Annual fee income (0·8 × e × p) 3600		22

Notes to Figure 4

1. PEC educational staff give the title of the course.
2. They determine its length: at 300pp it will have 3 volumes.
3. They say how many assignments it needs.
4. Tutors on comparable courses are paid $0.75 for each assignment.
5. The course may get out of date in 4 years.
6. Similar courses attract about 250 students a year.
7. They usually cost about $18.
8. Overheads are divided by the Centre's total annual enrolment.
9. All students will get volume 1 so 250 copies are needed.
10. But drop-outs mean that only ¾ will go on to volume 2.
11. ¾ will go on to volume 3.
12. This is therefore the total number of volumes to be printed.
13. Authors of similar courses are paid $420.
14. Analysis of PEC costs shows that it will cost this to edit the text, design it and set it in type.
15. The total costs for generating the course, to the point where it is ready for printing, are the total of these two costs.
16. It costs PEC $1.24 to print a 100-page volume, including paper costs. The total print costs are $1.24 multiplied by the annual number of volumes and by the 4-year life of the course.
17. The annual costs include ¼ of the generation cost (as it is to run for 4 years).
18. They also include ¼ of the print cost.
19. Tutors' fees: from past experience PEC knows that students do not do all the assignments. They usually do 60% of them. So the tutors' fees are 60% of the total number of assignments multiplied by the marking fee and by the number of enrolments.
20. Overheads — the rate per head multiplied by the number of enrolments.
21. Sometimes there will be extra costs — if there is any extra expenditure which arises just because of this course. There are none for *Revolutionary literature*.
22. Some students do not pay all their fees, and some get refunds. From experience PEC knows that the actual fee income is therefore likely to be only 80% of the proposed fee multiplied by the annual enrolment.

these calculations were made we assumed that the People's Education Centre had been running for some years, so that it could estimate reasonably well the likely annual enrolment for the Centre generally, and for this new course in particular. In a new institution, much more guesswork would be necessary.

As with the Lesotho example, there are many different ways of estimating course costs and this model is unlikely to be right, as it stands, for another institution. But it could readily be adapted to differing circumstances. Nevertheless it has a number of weaknesses.

First, it is concerned just with the costs of print. For a multi-media course, using radio and some face-to-face study, one would need a more complicated form. If, for example, radio costs were met by a broadcasting station and not by the Centre, it would also be necessary to consider which costs were met by the Centre and which by other agencies. The form is not sophisticated enough to calculate the effects of varying the amount of different ways of teaching: one would need, for example, to develop something more complicated in order to look at the effects of different combinations of print, radio and television.

Second, there are a number of decisions which need to be taken before the form is used, or which lie beyond its limits. PEC might need, for example, to decide the minimum annual enrolment which it should accept as a criterion for commissioning a course. If it were to develop an extremely wide range of courses, with very low enrolments, the overheads would rise above the level used for the calculations in Figure 4. Similarly, the Centre requires some criterion for deciding what to do about courses whose expected return falls very near the break-even point.

The third difficulty follows from this. The form is concerned with the cost of a single course, and it is often necessary to look at the effects of a group of courses as a whole. A college which is running a number of courses may want to recover a larger amount of its overheads from the most popular courses and so, in effect, to subsidise other less popular courses. A form of this kind will show an apparent surplus on the most popular courses and there is a danger that this will encourage expenditure on these courses, at the expense of others.

Thus it is often important to be able to analyse the cost of a single course, and a form of the kind in Figure 4 helps that process. It is a valuable tool for editors who need to choose between alternative courses, or alternative ways of producing courses, within an agreed policy. On the other hand the information derived from such an analysis is only a limited guide to policy. Sound decision-making demands more information, and decisions based on wider financial and educational criteria. We turn now to this kind of analysis.

The Snowden-Daniel variation

Barry Snowden and John Daniel, at Athabasca University in Canada, have analysed some of the problems of costing what they call 'small open universities'. Their analysis is concerned with the problems of institutions whose students are numbered in the thousands, rather than the tens or hundreds of thousands. Much of their work is applicable to teaching institutions other than universities, and it concerns broader issues than the two discussed in this chapter so far. Their work rests on the kind of economic analysis of distance teaching which we discuss in the next chapter but, as it provides valuable information for management, it is appropriate to look at it here.

Snowden and Daniel (1980) wanted to develop a model which would describe the behaviour of costs in a distance-teaching institution and which would help managers. Their starting point was an analysis of the costs of the British Open University which had already been carried out by Leslie Wagner (1977). Wagner had shown how the Open University had very high fixed costs, especially as compared with conventional universities. He went on to argue that one could usefully break down the university's costs between those that were fixed, those that varied with the number of students, and those that varied with the number of courses developed by the university. He showed that in 1976 the university spent £100,000 on each course, £248 on each student, and had fixed costs of £6,967,000. This can be shown in the formula:

$$TC = 6{,}967{,}000 + 100{,}000x + 248y$$

where TC = total cost
x = number of courses
y = number of students.

This does not tell us very much; it enables comparisons to be made between the costs of the Open University and the costs of conventional universities, but it is of little help in analysing the financial effect of different policies. Snowden and Daniel therefore went on to develop a more refined formula. In particular they distinguished between the costs of developing new courses and of maintaining existing ones, through revision and reprinting, for example. This suggests that a distance-teaching institution's costs can be regarded as comprising four elements: fixed costs; the costs of developing new courses; the costs of maintaining courses; and the costs involved in teaching students. An analysis of actual expenditure on the lines of the one shown in Table 8 makes it possible to calculate each of these figures. The formula for calculating the total annual cost is then:

$$TC = a_1x_1 + a_2x_2 + by + c$$

where x_1 = number of courses being developed
x_2 = number of existing courses
y = number of student enrolments
and a_1 = development costs per course
a_2 = maintenance, revision and replacement costs per course
b = cost of teaching for each student enrolment
c = fixed or overhead costs.

The life of a course — the length of time for which it is to be offered — naturally affects the development cost (a_1). On the assumption that the normal life of a course is five years, Athabasca University found that, between 1977 and 1980, it cost each year, in Canadian $$, between about $10,000 and $17,000 to develop each new course, about $2,000 to $3,500 to maintain each existing course and between $425 and $475 to teach each student, while fixed costs were between about $1,000,000 and $2,000,000. The equations are:

$$TC\ (1977\text{-}78) = 16{,}775x_1 + 3{,}555x_2 + 475y + 937{,}800$$
$$TC\ (1978\text{-}79) = 9{,}880x_1 + 1{,}975x_2 + 480y + 1{,}237{,}650$$
$$TC\ (1979\text{-}80) = 10{,}425x_1 + 2{,}085x_2 + 425y + 1{,}711{,}900$$

These equations still show a very large proportion of the university's costs as being fixed, although we know that in practice these will change, over the long run, with different numbers of students and of courses. Snowden and Daniel therefore apportioned the fixed costs between the three different activities of the university — developing courses, maintaining courses and teaching students. They used a different approach from that shown in the lower half of Table 8, but with the same aim of eliminating the fixed costs from their analysis. Having done this, they produced revised figures showing that the full costs were between $14,000 and $27,000 for developing new courses, between $2,900 and $5,400 for maintaining courses and between $690 and $760 for teaching each student. The revised equations for these full costs are:

$$TC\ (1977\text{-}78) = 26{,}650x_1 + 5{,}330x_2 + 760y$$
$$TC\ (1978\text{-}79) = 14{,}695x_1 + 2{,}940x_2 + 715y$$
$$TC\ (1979\text{-}80) = 16{,}380x_1 + 3{,}275x_2 + 670y$$

Now we have got a formula which can be used to help management in the short run. It is appropriate for an institution like Athabasca, whose major activities lie in correspondence and face-to-face teaching; one would develop a different formula, on the same principles, for an

institution with a wider range of activities. A college that was teaching two quite different groups of students, and also making radio programes, would want to use a formula that distinguished those activities, perhaps of this form:

$$TC = a_1x_1 + a_2x_2 + b_1y_1 + b_2y_2 + dz$$

where x_1 = number of courses being developed
x_2 = number of existing courses
y_1 = student enrolments on formal courses
y_2 = student enrolments on non-formal courses
z = number of radio series
and a_1 = development costs per course
a_2 = maintenance, revision and replacement costs per course
b_1 = cost of teaching for each formal course enrolment
b_2 = cost of teaching for each non-formal course enrolment
d = cost of running a radio series.

In Athabasca, their formula was used to predict future expenditure and then to see the effect of various changes on the total expenditure. Thus they calculated, in the light of previous experience, that the cost of developing courses was likely to stay at $16,400, and of maintaining them at $3,300, while the cost of teaching each enrolment would fall slightly to $650. This enabled them to calculate projected costs *(PC)* with the formula

$$PC = 16,400x_1 + 3,300x_2 + 650y$$

By referring to the academic plan, which showed the number of students and courses proposed for the future, they could then forecast expenditure for 1980/81 as in Table 9.

Table 9: Proposals for Athabasca University 1980/81

Currency: Canadian $$

	Development of new courses (x_1)	*Maintenance of existing courses (x_2)*	*Enrolments (y)*	*Total*
Number proposed	66	234	5,925	
Total cost	1,082,400	772,200	3,851,250	5,705,850

The formula also makes it possible to see the effect of policy changes on the cost, and the management, of the university. If, for example, Athabasca decided that the life of the average course should be shortened to four years, or lengthened to six, it would be possible from this analysis to calculate the effect on the total cost of the university. Similarly Snowden and Daniel show precisely how far, if the cost of producing courses were held down, the university would be able to develop more courses. The formula also makes it possible for the university to see what the alternatives would be, if it were faced with a demand to cut its total expenditure, or to reduce the cost per student.

To demonstrate the value of the formula, we can look at Athabasca's policy on developing new courses. Athabasca develops about two-thirds of its own courses, and buys the others from other institutions. It is cheaper to buy courses than to develop them from scratch: other distance-teaching institutions tend to sell them at a price nearer to the marginal than to the average cost. If we assume that it costs three times as much to develop a course as to acquire one (our assumption, not Snowden and Daniel's) and that we can round the cost of course production to $21,000 for writing a course and $7,000 for acquiring one, then Athabasca's costs for 1980/81 would be:

on developing new courses	44 × $21,000	=	924,000
on acquiring new courses	22 × $ 7,000	=	154,000
total for new courses			$1,078,000

Assuming that the Athabasca faculty would agree, there would obviously be savings in developing fewer courses from scratch and acquiring more from other institutions. In Table 10 we see the effects of different policies about new courses on the total expenditure of the university, and on the cost per student enrolment. This is, of course, a theoretical calculation and deliberately leaves aside educational arguments about the merits of one policy rather than another. It also assumes that the university's other costs were unchanged.

Thus, to sum up, an analysis of the kind made at Athabasca breaks down the costs of a distance-teaching institution and relates these to the most important variables. In Athabasca's case these were the number of courses being developed, the number being maintained and the number of of students. A formula of this kind then makes it possible for the manager to compare the effects of alternative policies on the expenditure of his institution. We have examined the effects of policy changes on course development, but the same approach would enable the manager to assess a variety of other changes on the recruitment of students, the maintenance of courses, fees to be charged, and so on.

Table 10: Possible effects of course development policies on Athabasca costs 1980/81

Currency: Canadian $$

Mix of courses	*Costs of developing courses*	*acquiring courses*	*Total university expenditure*	*Average cost per student enrolment*
66 developed 0 acquired	1,386,000	—	6,009,450	1,014
44 developed 22 acquired	924,000	154,000	5,701,450[a]	962
33 developed 33 acquired	693,000	231,000	5,547,450	936
22 developed 44 acquired	462,000	308,000	5,393,450	910
0 developed 66 acquired	—	462,000	5,085,450	858

Note

a. This is lower than the figure quoted in Table 9, as we have rounded down the cost of course development or acquisition. The effect of this change is to reduce the average cost per enrolment by $1.

Measuring the cost of teaching

Some managers are required to relate work done through distance teaching to orthodox, face-to-face, teaching. In England, for example, in the last few years a number of colleges of further education have begun to use distance-teaching materials. Generally they have provided tutorial support for correspondence texts. Barnet College of Further Education, for example, offers some part-time day and evening classes, and some courses through what is called 'FlexiStudy'. FlexiStudy students receive National Extension College correspondence texts. They do not attend classes on a regular basis but send their work to a Barnet College tutor to be marked and can come to the college for advice and help when they need to. This method of working is an unorthodox one for an English college. Barnet therefore had to work out how to cost and charge for FlexiStudy, and how to compare it with the regular part-time or full-time work of the college. Other colleges have faced similar problems and many have followed a similar approach to Barnet's.

Much work in colleges of further educaton is assessed in terms of contact hours. A contact hour is defined as the length of time a tutor is in contact with a class; lecturers' contracts often specify the number of contact hours they are required to have in each week of the 36-week year. But where, as with FlexiStudy, students attend the college

intermittently, but may have contact with it by post and telephone as well, there is no obvious way of equating contact hours with tutoring for something like FlexiStudy.

Barnet therefore approached the problem the other way round. It suggested that each FlexiStudy student deserved as much attention as a student would get on an equivalent course. As many of the FlexiStudy courses were for secondary-level qualifications (GCE), it was possible to make a comparison between FlexiStudy and evening classes leading to the same qualifications. The college argued:

1. Let us suppose that in work-load terms one FlexiStudy student is equivalent to one student enrolled on an evening class which is scheduled to meet for x hours per week for one academic year.
2. Let us further suppose that the (nominal) class size for such an evening class is y.
3. Then the lecturer teaching this evening class handles the equivalent of y FlexiStudy students in x class-contact-hours per week or y/x FlexiStudy students per class-contact-hour.

(Birch and Cuthbert 1981, p.54)

In practice at Barnet the average GCE evening class had about 20 students and met for two hours a week, so that y/x was 10. In other words, Barnet assumed that the work of looking after 10 FlexiStudy students was equivalent to one contact hour per week. Thus, agreement on such a case load would mean that the cost of tutoring FlexiStudy students was roughtly equivalent to the cost of regular evening class teaching.

This approach has the merit of simplicity, but also has its disadvantages. We do not know whether this allocation of time is perceived as being reasonable either by the tutor or by the student. On this example, with an academic year of 36 weeks, the average FlexiStudy tutor would have 72 hours to devote to ten FlexiStudy students. Now, if he could provide them with good and effective tutoring by running 18 fortnightly one-hour group sessions and giving a total of five hours' individual tuition to each student, the job would be very close to the nominal allocation of contact hours. But if he found that, on average, his students needed eight hours of individual tuition, spread over the year, then he could well feel he was being overworked, or underpaid for his FlexiStudy work, as compared with his ordinary teaching. As yet there seems to be too little experience to see whether the norms which emerge from the Barnet formula are realistic. And there is little experience to suggest how such FlexiStudy tuition could be monitored in order to ensure both fairness and quality.

Nevertheless, the use of a contact hour formula does make possible

comparison between tutoring distance students and teaching face-to-face, and enables education authorities and teachers' trade unions to carry out the necessary negotiations about teaching load. It also makes it possible to go on and calculate the costs of something like FlexiStudy. (In order to make these comparisons, it is, of course, also necessary to include the costs of producing printed teaching materials). If comparisons are to be made between institutions, there are three pitfalls here. First, the loan charges for capital vary, not only according to the level of work of the institution, but also according to its age. Most studies in England have therefore omitted loan charges from the calculations. Second, the actual salaries paid in any one institution are a function of the age and experience of its staff. It has therefore been suggested that one should use not actual, but notional salaries, calculated by reference to the mid-points of the salary scales of the relevant staff. Third, many educational bodies, and especially universities, see teaching as only one of their functions, and it is necessary to agree the proportion of their costs which should be attributed to activities such as research.

There is one further problem in comparing the work of teaching at a distance with conventional teaching: assessing the cost of preparing written material. There are three obvious approaches. The first is to agree a fee, in the light of teachers' expectations about payment for freelance work. This is how both South West London College (a public body) and the National Extension College (a private one) have worked. The second is to regard this simply as part of the teacher's regular work. South West London College, for example, has also arranged for some writing to be done as part of staff's regular work and says that the time spent is just *'shown on the time sheet'* (Spencer 1980, p.199). Third, Doncaster Metropolitan Institute of Higher Education got an agreement between the local education authority and the lecturers' trade union about the comparison between writing a correspondence unit and teaching regularly; they agreed that the work involved in preparing a standard lesson of 3,000 to 4,000 words, including illustrations and assignments, was the equivalent of a week's work (30 hours), and therefore merited a week's pay, plus an extra payment for surrender of the copyright (Davies 1977, p.74).

Conclusion

The examples quoted earlier in this chapter suggest that simple and conventional book-keeping techniques can be adapted by distance-teaching institutions and yield conclusions which will be of practical value to managers. Beyond that, an analysis of the key functions of a distance-teaching organisation, and of the costs to be attributed to

them, help the manager to assess the financial implications of different policies. In comparing distance-teaching with orthodox education, we are in greater difficulty. It is possible to adapt standard educational measures, like teachers' contact hours, and bend them to fit distance-teaching, but only with difficulty and only at the cost of making arbitrary decisions about which kind of work can be equated to what. And yet, as distance teaching comes to be seen more as a technique to be associated with conventional forms of education, these kinds of measures will become more important to more managers. Some help in solving the problems they present may be found in the economic analysis of distance education to which we now turn.

Chapter 6: Costing for economic analysis

We now turn to the economist's view of distance teaching, in order to examine the methods by which we can compare the full cost of distance teaching with alternatives.

It is conventional to distinguish between cost analysis, cost effectiveness analysis and cost benefit analysis. In cost analysis we simply try to discover all the costs involved in a particular activity. The procedure used at Lesotho Distance Teaching Centre and discussed in Chapter 5 is the first stage towards cost analysis. Cost effectiveness analysis goes one stage further. It tries to measure the different costs of different ways of achieving the same end. If, for example, we defined our aim as to provide teaching, in a particular subject and at a particular level, to 100 children, cost effectiveness analysis enables us to say which of various alternative methods of teaching will prove cheapest. Cost benefit analysis goes further still. It involves measuring the benefits of a policy in terms of money. Thus, whereas in cost analysis or cost effectiveness analysis, we are merely concerned with the costs of education, in cost benefit analysis we are trying to put a price on its effects or benefits. Opinions differ as to how far this is possible, sensible or desirable. Among the difficulties of cost benefit analysis is that of putting a financial value on something, such as more education or better health, which is not priced and sold in the same way as butter or eggs. This chapter stops at cost effectiveness analysis. This can yield answers that are valuable for educational planners, for example, who want to compare conventional with unconventional ways of achieving the same result. It also enables us to look at the effects of increasing or decreasing numbers of students on the costs of education: the Athabasca calculations discussed in the last chapter make this possible.

Cost analysis

Over the last few years a measure of agreement has been reached about ways of analysing the costs of distance teaching and educational broadcasting. The method suggested here is, broadly, the one discussed in Jamison, Klees and Wells (1978), Unesco (1977) and Unesco (1980),

and a fuller account of it can be found in the first of these. It has been used for most of the studies whose results are summarised in Chapter 4.

There are four stages to the analysis:

- find all the costs;
- separate the running costs from the capital costs and annualise the latter;
- identify the fixed and variable costs;
- calculate a cost function relating costs to an educational measure, such as the number of students or the number of courses.

In carrying out this kind of analysis we are faced with the problems already discussed in Chapter 2 and by two particular difficulties. The first is about the measure we use in the last stage of the analysis. We need some kind of measure of education by which we can compare different methods of teaching. For some purposes we can measure the cost per student-hour. This is simple, but carries the hidden assumption that a student learns equally effectively no matter how he is taught. Or we can measure the number of students reached, which means that we neglect drop-out rates and the possible difference between them for different groups of students. If we can measure the number of students completing a course, or the number passing an examination, comparisons may be easier — though we need to remember that the student populations studying at a distance and in school, say, are seldom comparable. There is no easy answer, but it is important for the readers of evaluation reports to see just what assumptions have been made about such measures, and for their writers to be aware of and open about the difficulties.

A second set of problems confront us when we ask 'Who pays the bill?' So far, we have been mainly concerned about the costs of distance-teaching to the institutions. The economist, however, may be interested in the total cost to society of different kinds of education. And the costs are met by different people. If, for example, we are teaching by radio and by print, then the cost of making and distributing printed materials may rest with a distance-teaching institution, whose interest in costs may end there. The costs of transmission, and perhaps production, of radio programmes may rest with a radio station. If we are broadcasting to individual adults, they will probably themselves have had to pay for their radio sets, while if we are broadcasting to schools, the ministry of education may have had to meet that cost. Our difficulties here are partly practical and partly theoretical. The practical difficulty is that we may forget to include a cost which belongs to a different organisation. Theoretical difficulties arise, partly for the

reasons discussed in Chapter 2 about the price to be charged for broadcasting time, and partly because of the difficulty of assessing something like the proportion of the cost of possessing and running a radio set which should be attributed to educational listening.

Working out the costs

An economist wanting to assess the costs of a distance-teaching project thus needs to start by seeing how she can best overcome these problems and then go on to discover and add up all the costs. There are three obvious sources for these. The first is an institution's budget, or what it proposes to spend. Budgets need to be treated with caution, as estimates of future expenditure are often wrong. The Plato IV system of computer-based teaching in the USA, for example, was budgeted to cost $1 per student hour, but actually cost $5. The second, which is better, is to use an institution's record of actual expenditure in the past. But many of the costs of an institution will not appear in its budget and may not appear in any balance sheet. A government college may, for example, have nothing in its budget which relates to the value of its buildings. Thus we need a third approach, which is to look round and make a note of all the buildings and equipment which a project has. Unesco has suggested a standard list of headings for the costs of mass media projects:

Buildings of a general nature
Special buildings
  studios
  other
Equipment and materials (including vehicles)
Consumable furniture and spare parts
Labour
Other resources
  energy per type and mode of transmission
  other

(Unesco 1977, p.31)

In listing all the kinds of expenditure for a project, it is important to ask about those costs which are met by other institutions. It is also important to begin thinking about the ways the costs relate to different activities. Many institutions may already have an analysis of the kind in Table 8, which can help with this allocation. At this stage it will often be useful to divide costs between three kinds of activity: production,

transmission or distribution, and reception. Often the last of these costs falls on the student, or on somebody other than the teaching organisation.

Some figures may not be readily available. A college may stand on land which has been given, or provided free, by government. Should the economist include a figure for this land? She can decide this by considering the point of her enquiry. If she is comparing the cost of teaching at a distance with the cost of school teaching in a country where land is normally provided free to schools, then it may be quite realistic to omit it. If, on the other hand, a distance-teaching institution must have its headquarters in the centre of the capital city, and pay a high rent for its position, then that should be reflected in its costs. Where the building was paid for outright in the past, and there is no information available about its original cost, she can substitute the cost of a comparable building today.

Table 11: Costs for radio section of Extension Aids Branch, Malawi

Currency: Malawi Kwacha

Item	*Cost*	*Where information obtained from*
Recurrent		
Salaries and wages	13,300	Annual accounts
Travel	4,200	Annual accounts
Miscellaneous	1,100	Annual accounts
Radio transmission costs	194,500	Study carried out by Malawi Broadcasting corporation giving hourly broadcasting costs
Capital		
Vehicles	13,880	Replacement cost of one vehicle
Building	24,000	A proportion of the current cost of building a comparable block in Lilongwe at the time of the study
Recording material	8,000	Annual accounts

Having discovered all the activities of the institution, and found out as far as possible its running costs and the value of its equipment and buildings, it is necessary to separate out capital from recurrent costs. Table 11 shows the set of costs which we identified when doing a study of the radio work of the Extension Aids Division of the Ministry of Agriculture in Malawi. It will be seen that it is fairly easy to decide which costs are recurrent and which are capital. But it is important then to separate the one from the other. If we were merely to analyse expenditure in one year, then the costs would be very high in a year when a

new building, or a new fleet of vehicles, was acquired, and much lower in years without such heavy capital expenditure. We do this by turning the capital cost into an annual cost, or annualising it. This is equivalent to thinking about an annual rent, for a building or a vehicle or a piece of equipment, rather than thinking about its capital cost. We can calculate this once we know the original, or replacement cost, of something and its expected life. (If our starting point is the accounts of a private organisation, we may find that these accounts already include a figure for depreciation. This represents the value lost to the institution as, for example, its capital equipment wears out. It is important not to include this figure as well as the annualised figure just discussed, as this would mean we were including the same item twice).

As we saw, many economists claim that it is not legitimate to divide the cost by the expected life, but that we should include in the calculations an element for the opportunity cost of the capital used. The argument is discussed in a later section of this chapter. In our analysis of the Malawi costs we used an interest rate of 7.5%. This enabled us to produce the results in Table 12 which now show the total Malawi radio costs on an annual basis.

Table 12: Annual costs for radio section of Extension Aids Branch, Malawi

Currency: Malawi Kwacha

Item	*Capital cost*	*Expected life in years*	*Annualisation factor at 7.5%*	*Annual cost*
Salaries and wages				13,300
Travel				4,200
Miscellaneous				1,100
Radio transmission costs				194,500
Vehicles	13,880	4	0.299	4,150
Building	24,000	50	0.077	1,850
Recording material	8,000	4	0.299	2,392

The next stage is to separate the fixed costs from those which vary with the number of students. This is necessary if we are to relate costs to an educational measure, such as the number of adults reached, or the number of examination passes. Some costs are clearly fixed, in the sense that they do not vary with the number of students recruited.

These would include the rent of the headquarters or the cost of transmitting broadcasts. Others clearly do vary with the number of students: fees to tutors for marking correspondence work, for example, vary with the number of active students, while much of a correspondence college's postage bill varies in the same way. But some things are not so clear cut. As we saw, and as Snowden and Daniel argued, in the long run even fixed costs will vary. Thus it is reasonable to say that the fixed costs would not change if we increased student numbers from 7,000 to 7,500, but unreasonable to suggest they would be the same if we moved from 7,000 to 70,000. And it is difficult to determine whether some costs should be regarded as fixed or variable: if a college advertises for students, its advertising costs will vary with the number of students if its advertising campaign is successful. If it is unsuccessful, and recruits no more students than it gets from other sources, then the costs of advertising should be regarded as fixed.

Once we have identified all the costs in a project, annualised the capital costs, and separated fixed from variable costs, it is possible to calculate the cost function. This will show us what the cost per student will be for differing numbers of students. (We would use exactly the same procedure if we were trying to get the cost per examination pass, or per farmer contacted). If we are measuring the cost per student, we divide the total variable cost by the number of students in order to get a variable cost per student. Then we can say that the total cost of the project is the variable cost per student, multiplied by the total number of students, plus the fixed costs. This is expressed in the formula:

$$TC = VN + F$$

where TC = total cost
V = variable cost per student
N = number of students
F = fixed cost.

If we want to look at the average cost per student for a given number of students, we can divide the total fixed costs by that number, giving the formula

$$AC = \frac{F}{N} + V$$

where AC = average cost per student.

We can now look, too, at the marginal cost. The marginal cost is the extra cost we incur by expanding our educational system by reaching, or teaching, one more person. As the fixed cost is unchanged, the

marginal cost is the same as the variable cost. Characteristically, as we saw, in distance teaching the marginal cost is a smaller proportion of the total cost than in conventional education.

Social discount rates

We have seen that the economist will usually want to include a figure for capital in making comparisons between the costs of different kinds of education. Many economists argue, as we saw, that one should include as part of the cost of capital the income forgone if we invest in buildings or goods rather than trying to earn interest on our capital. It is claimed that, unless we do so, we seriously underestimate the capital cost of projects. Furthermore, unless we take account of this factor, we are, in effect, saying that there is no difference between making an investment now, and making it at some time in the future. (It is, of course, easier to convince economists to include a social discount rate than managers. Managers are generally concerned with their budget over a limited period of time, and influenced more by the ease of raising capital for a particular project from a donor agency than by its cost).

Against these arguments, Eicher has pointed out:

> In principle, the theory seems clear and accepted by all specialists. Investment creates capital which normally remains productive over a period of years, thereby freezing assets that might have been used to produce something else. It is necessary, therefore, to take capital productivity into account by adding to the annual amortisation a sum corresponding to the rate of profit which has been renounced. In fact, this procedure is neither so easy to apply nor as clear-cut as it may seem
>
> First, it is important to distinguish between the annualisation process, which consists in distributing the value of the investment over the presumed number of years of usage, and the use of an interest rate. The first procedure has only a practical goal, at least in theory — that of making the costs for one period correspond with the services rendered by the capital for that same period. For example, it would be absurd to apply the total cost of a building to the year of construction.
>
> Conversely, the use of an interest rate rests on the hypothesis that is neither clear nor indisputable. The reason often given is that interest might have been obtained by lending the funds instead of using them for the purchase of a building or equipment. However, this argument is not an explanation and its validity can easily be challenged insofar as it is not based on an economic theory. By itself, it consists of equating to a loss to the community or at least to the person acting in its name what the cost of rejection represents for one individual. As it is difficult to imagine a minister of education having a choice between spending his construction budget and lending it to a bank, it has to be assumed that the opportunity cost is zero.
>
> If we go further and refer to the theories of interest, we find that, roughly speaking, they are of two types: those that put emphasis on the supply side,

the so-called 'loanable funds' theories which are based on the notion of preference for the present; and those that stem from demand and are based on the hypothesis of capital productivity. Only in capitalist economies where perfect competition existed would the confrontation of supply and demand give rise to a price of capital that would be 'the' interest rate.

However, capital markets are at best very imperfect and the concept of a social discount rate that could be derived from time preference on the part of the community is very vague.

This being so, it could seem that the conclusions to be found in many documents to the effect that (a) a positive rate of interest must be used; (b) 7.5 per cent appears to be a reasonable rate, do not rest on sound theoretical bases. On the one hand, nobody knows the actual time preference rate of the community and, on the other hand, one is not entitled to use for other various situations and types of communities a procedure that is fully justified only in a competitive capitalist economy.

(Eicher, in Unesco 1980, p.13)

Despite the strengths of these arguments, the consensus on this issue seems to be against Eicher. Perhaps most of the micro-economists working in this area are more dedicated to orthodox capitalist economics than he is. Most recent studies have used a discount rate, usually of 7.5% or 10%.

The formula most often used for calculating the annualisation factor is one given by Jamison, Klees and Wells (1978, pp.32-3), and also discussed by Kemeny *et al.* (1962), Ch.6. We use an annualisation factor, $a(r, n)$ and multiply this by the capital cost, C, in order to get the annual cost. To calculate $a(r, n)$ we use the formula:

$$a(r,n) = r(1+r)^n/(1+r)^n - 1$$

where $a(r,n)$ = annualisation factor
n = lifetime of capital in years
r = prevailing interest rate or discount rate.

Thus, when calculating the annual value of the buildings in Malawi, which would have cost K300,000 to build and had an expected life of 50 years, the formula gave us:

$$\text{annualised cost} = 300{,}000 \times 0.075(1.075)^{50}/(1.075)^{50} - 1$$

which is equivalent to K23,122.

In practice it is probably easier to use a set of values from a table than to calculate them every time. Table 13 therefore gives the values of the annualisation factor for the most commonly used figures. To get an annual value for capital, you then simply have to multiply the capital

value of the figure for the appropriate life of the capital equipment and the chosen interest rate by the factor shown.

Table 13: Values of the annualisation factor *a(r,n)*

Life of capital equipment in years (n)	*Interest rates (r)*			
	0%	*7.5%*	*10%*	*15%*
1	1.000	1.075	1.100	1.150
2	0.500	0.557	0.576	0.615
3	0.333	0.385	0.402	0.438
4	0.250	0.299	0.315	0.350
5	0.200	0.247	0.264	0.298
6	0.167	0.213	0.230	0.264
7	0.143	0.189	0.205	0.240
8	0.125	0.171	0.187	0.223
9	0.111	0.157	0.174	0.210
10	0.100	0.146	0.163	0.199
15	0.067	0.113	0.131	0.171
20	0.050	0.098	0.117	0.160
25	0.040	0.090	0.110	0.155
30	0.033	0.085	0.106	0.152
40	0.025	0.080	0.102	0.151
50	0.020	0.077	0.101	0.150

The argument about discount rates is not purely academic. If we want to compare types of education which are capital-intensive with those that are labour-intensive, it is important to agree about the proper treatment of capital. The larger the proportion of capital costs in a total budget, the more important is the decision about the discount rate adopted.

The problem of time

The annual expenditure of many educational projects varies sharply over time, even if we iron out the effects of inflation. A new venture may have very high costs, and very few students, in its first year. Later, any one year may be atypical because of the state of the country's economy, the incidence of postal strikes, changing policies on recruiting students or staff and so on. Often, an economic analysis is like a still photograph: it looks at an institution at the time the study was made. It may catch a good likeness, or it may be distorted because the organisation was running faster than usual, or temporarily dormant. There are therefore strong arguments for looking at costs over a period of years, rather than for any one year. Unfortunately, the data to make this kind of study are seldom available, and relatively few

studies have actually made an analysis of expenditure over a period of years. More have tried to find the costs for a typical year. If we want to look at costs over time, the first move is to convert all costs to constant currency by using an appropriate price index. Then we can average the costs over this period. For a fuller discussion of this procedure, which is more widely recommended than used, see Jamison, Klees and Wells (1978), p.35.

66

Chapter 7: Conclusions

The evidence does not make it possible for this broadsheet to end with a simple statement about the conditions under which distance teaching is cheaper or dearer than the alternative. Using methods discussed in the latter chapters, and the evidence surveyed in the earlier part, it is possible only to claim that there are circumstances in which distance teaching looks attractive from an economic point of view. Economies of scale are possible. But distance education characteristically has high fixed costs and, with relatively low student numbers, its costs can be higher than those of conventional education. The collapse of expensive, technologically advanced systems of education, like the television services of Glasgow and of the Ivory Coast, give a warning echo to those who believe that high fixed costs and low variable costs are a recipe for cheap educational innovation or improvement.

In Chapter 3 we have set out the evidence, such as it is, on the cost of broadcasting and of print, and in Chapter 4 on the comparative cost of distance education and its orthodox alternative. What of the future?

First, we can hope for a close relation between these two kinds of study. In this broadsheet, we have been hampered by the lack of evidence which breaks down distance teaching into its component parts. In the absence of such a breakdown, we cannot predict the behaviour of different mixes of print and broadcast, on the one hand, and face-to-face study on the other. And yet it is on the mixing of such media that the educational strength of distance education depends.

Second, perhaps one effect of the cold wind blown by politicians and economists of the Reagan/Thatcher axis will be a sharper analysis of the cost of education. It is an ill wind that blows no good: an ill-conceived search for economies in welfare and education may at least force us to see better how best to use our wrongly depleted resources. A minor result of that would be to make the next edition of this study a more fully illustrated one.

Third, the issues involved in comparing distance with orthodox education within the same institution are assuming greater importance than their brief discussion here suggests. As more colleges and schools, in many countries, offer choices between different modes of study, so the need to compare their costs, and their work loads for staff and students, becomes more important.

Appendix: Inflation rates

In order to make it easier to compare costs, many figures in this broadsheet have been converted to US 1978 dollars, using the following conversion factors which are based on the US consumer price indexes. To convert from dollars in any of these years to 1978 dollars, multiply by the factor shown.

1972	1.58
1973	1.49
1974	1.34
1975	1.23
1976	1.16
1977	1.09
1978	1.00
1979	0.88
1980	0.80

We have usually converted other currencies into dollars at the exchange rate prevailing at the time the expenditure concerned was made.

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71